

What is claimed:

5        1. A copper electroplating composition comprising:  
at least one soluble copper salt,  
an electrolyte, and

10        one or more brightener compounds that are present in a concentration of at least about 1.5 mg per liter of the electroplating composition.

15        2. The composition of claim 1 wherein the concentration of the brightener agent is at least about 2 mg per liter of the electroplating composition.

20        3. The composition of claim 1 wherein the concentration of the brightener agent is at least about 4 mg per liter of the electroplating composition.

25        4. The composition of claim 1 wherein the concentration of the brightener agent is at least about 10 mg per liter of the electroplating composition.

30        5. The composition of claim 1 wherein the concentration of the brightener agent is at least about 25 mg per liter of the electroplating solution.

35        6. The composition of claim 1 wherein the one or more brightener compounds contain one or more sulfur atoms.

40        7. The composition of claim 1 wherein the one or more brightener compounds comprise one or more sulfide or sulfonic acid groups.

45        8. The composition of claim 1 wherein the one or more brightener compounds comprise a group of the formula R'-S-RSO<sub>3</sub> where R is optionally substituted alkyl, optionally substituted heteroalkyl, optionally substituted aryl, optionally substituted heteroaromatic, or

optionally substituted heteroalicyclic; and R' is hydrogen or a chemical bond.

9. The composition of claim 1 wherein the composition further comprises a suppressor agent.

10. The composition of claim 9 wherein the suppressor agent is a polyether.

11. The composition of claim 1 wherein the composition further comprises a leveler agent.

12. The composition of claim 1 wherein the electroplating composition is acidic.

13. A method for plating an electronic device substrate containing one or more apertures, the method comprising:

electrolytically depositing onto the substrate copper from an electroplating composition that comprises at least one soluble copper salt, an electrolyte, and one or more brightener compounds that are present in a concentration of at least about 1.5 mg per liter of the electroplating composition.

14. The method of claim 13 wherein the brightener concentration is at least about 2 mg per liter of the electroplating solution.

15. The method of claim 13 wherein the brightener concentration is at least about 10 mg per liter of the electroplating solution.

16. The method of claim 13 wherein the substrate is a printed circuit board substrate or semiconductor with one or microvias.

17. The method of claim 16 wherein the one or more microvias have an aspect ratio of at least about 4:1 and diameters of at least about 200 nm.

18. The method of claim 17 wherein copper is deposited to fill the one or more microvias to provide a copper plate in the absence of voids or inclusions.

19. The method of claim 17 wherein the composition further comprises a suppressor agent.

20. The method of claim 13 wherein the substrate is a microchip module substrate.

21. An article of manufacture comprising an electronic device substrate containing one or more apertures each having walls, the aperture walls having thereon an electrolytic copper deposit obtained from an electroplating composition that comprises at least one soluble copper salt, an electrolyte, and one or more brightener compounds that are present in a concentration of at least about 1.5 mg per liter of the electroplating composition.

22. The article of claim 21 wherein the substrate is printed board substrate, a microchip module substrate, or a semiconductor chip substrate.

23. The article of claim 21 wherein the substrate comprises the one or more microvias that have an aspect ratio of at least about 4:1 and diameters of at least about 200 nm, and the walls of the one or more microvias have a copper deposit that is free of voids.

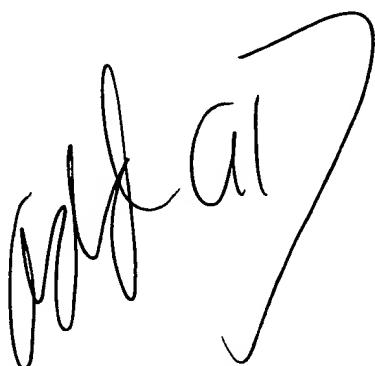
24. A process to remove excess material from a semiconductor wafer by using a chemical mechanical planarization process which comprises contacting the semiconductor wafer with a rotating polishing pad thereby removing the excess material from the semiconductor wafer; wherein the semiconductor wafer has been prior electroplated by a copper electroplating composition comprising:

at least one soluble copper salt,  
an electrolyte, and  
one or more brightener compounds that are present in a concentration of at least about 1.5 mg per liter of the electroplating composition.

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25. The process as claimed in claim 24, wherein said polishing pad is grooved.
26. The process as claimed in claim 24, wherein the semiconductor wafer is also subjected to a polishing slurry.
27. A process to remove excess material from a semiconductor wafer by using a chemical mechanical planarization process which comprises contacting the semiconductor wafer with a rotating polishing pad thereby removing the excess material from the semiconductor wafer; wherein the semiconductor wafer has been prior electroplated by the composition of claim 1.

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